Notes on the Use of the Tennessee Phosphorus Index

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Tennessee Phosphorus Index*

Part A: Phosphorus loss potential due to site and transport characteristics						
Transport	**Phosphorus Loss Rating**				**Before Value**	**After Value**
	(1 point)	***(2 points)***	***(4 points)***	***(8 points)***		
Hydrologic Soil Group (Table 1)	A	B	C	D		
Erosion Potential (Table 2)	-	Low	Medium	High		
Permanent Vegetative Buffer Width *(ft)	>29	20-29	10-29	< 10		
Non-Application Width from Surface Water source (ft)	>29	20-29	10-29	< 10		
				Part A: Total Site Value:		

* Permanent Vegetative Buffer must be installed, constructed, and maintained in accordance with applicable NRCS Conservation Practice Standard.

Part B: Phosphorus loss potential due to source and management characteristics						
Source	**Phosphorus Loss Rating**				**Before Value**	**After Value**
	(1 point)	***(2 points)***	***(4 points)***	***(8 points)***		
Soil Test P Value	Low	Medium	High	Very High		
P Application Rate (lbs/ac/crop or crop sequence/rotation)	0.20 x ______ lbs P_2O_5 applied as commercial fertilizer 0.10 x ______ lbs P_2O_5 applied as manure, litter, or biosolids 0.05 x ______ lbs P_2O_5 applied as alum amended poultry litter					
Application Timing	June – Sept.	April, May, Oct., March or Nov. w/ winter cover	March or Nov. w/o winter cover, Feb. w/ winter cover	Dec., Jan., Feb.		
Application Method	Injected/Banded 2" below the surface	Incorporated within 5 days of application	Incorporated more than 5 days after application	Surface applied (no incorporation)		
				Part B: Total Management Value:		

<u>Before Value</u> - Multiply Part A (_____) x Part B (_____) = ______ P Loss Rating

<u>After Value</u> - Multiply Part A (_____) x Part B (_____) = ______ P Loss Rating

* The index numbers and the interpretations, as well as the whole document will continue to be reviewed and evaluated, and are subject to modification as further field testing and validation of the index continues.

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Total Points from P Index	*Generalized Interpretation of P Index Points for the Site*
< 100	**LOW** potential for P movement from the field. If farming practices are maintained at the current level there is a low probability of an adverse impact to surface waters from P losses. Nitrogen-based nutrient management planning is satisfactory for this site. Soil P levels and P loss potential may increase in the future due to N-based nutrient management.
100 - 200	**MEDIUM** potential for P movement from the field. The chance for adverse impact to surface waters exist. *Nitrogen-based nutrient management planning are satisfactory for this field when conservation measures are implemented to lessen the probability of P loss*. Soil P levels and P loss potential may increase in the future due to N-based nutrient management.
201 - 300	**HIGH** potential for P movement from the field. The chance for adverse impact to surface waters is likely unles remedial action is taken. Soil and water conservation practices are necessary (if practical) to reduce the risk of P movement and water quality degradation. If risk cannot be reduced, then a P-based nutrient management plan will be implemented.
> 301	**VERY HIGH** potential for P movement from the field and an adverse impact on surface waters. All necessary soil and water conservation practices, plus a P-based nutrient management plan must be put in place to avoid the potential for water quality degradation.

<u>Description of Terms</u>

Part A: Phosphorus Loss Potential Due to Transport Characteristics

Hydrologic Soil Groups are categorized based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. Refer to Table 2-1 in Chapter 2 of the NRCS Engineering Field Manual. For a summary of the hydrologic groupings for most Tennessee soils see Table 1 (next page).

1.

The four hydrologic groups are:

Group A: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These soils have a high rate of water transmission.

Group B: Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C: Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D: Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

NOTE: If a soils is assigned to two hydrologic groups in Table 1, the first letter is for drained areas.

Table 1. Hydrologic Soil Groups for Most Tennessee Soils

Soil Series	Hydrologic Soil Group	Soil Series	Hydrologic Soil Group	Soil Series	Hydrologic Soil Group
Adler	C	Dubbs	B	Muskingum	C
Altavista	C	Dulac	C	Needmore	C
Amagon	D	Dunmore	B	Nolichucky	B
Arkabutla	C	Etowah	B	Paden	C
Armour	B	Falaya	D	Pembroke	B
Arrington	B	Forestdale	D	Pickwick	B
Barfield	D	Freeland	C	Providence	C
Baxter	B	Fullerton	B	Ramsey	D
Beason	C	Grenada	C	Robinsonville	B
Bedford	C	Guthrie	D	Rosebloom	D
Bewleyville	B	Hamblen	C	Routon	D
Bodine	B	Harpeth	B	Ruston	B
Bosket	B	Hartsells	B	Sango	C
Bowdre	C	Hatchie	C	Sengtown	B
Bradyville	C	Hawthorne	B	Sequatchie	B
Bruno	A	Henry	D	Sequoia	C
Byler	C	Holston	B	Sharkey	D
Calloway	C	Humphreys	B	Shubuta	C
Capshaw	C	Huntington	B	Smithdale	B
Center	C	Iberia	D	Staser	B
Christian	C	Jefferson	B	State	B
Clarkrange	C	Keyespoint	D	Statler	B
Collegedale	C	Leadvale	B	Stiversville	B
Collins	C	Lexington	B	Sullivan	B
Commerce	C	Lily	B	Taft	C
Congaree	B	Lindside	C	Talbott	C
Convent	C	Linker	B	Tasso	B
Crevasse	A	Lomond	B	Tellico	B
Crider	B	Lonewood	B	Tiptonville	B
Crossville	B	Loring	C	Tunica	D
Cumberland	B	Maury	B	Tupelo	D
Curtistown	B	Melvin	D	Vicksburg	B
Dandridge	D	Memphis	B	Waynesboro	B
Decatur	B	Mimosa	C	Waverley	B/D
Dellorose	B	Minvale	B	Whitwell	C
Dewey	B	Monogahela	C	Wolftever	C
Dickson	C	Montview	B		

Groups with B/D rating indicate Drained / Undrained

2. **Erosion Potential** is based on Table 2.

Table 2. Erosion Potential for Tennessee Soils

			Length of Horizontal Slope (ft)		
Slope %	**Cover**	**Texture of Top Soil**	**75**	**150**	**300**
0 to 2	Bare soil or conventional tillage	All textures	Low	Medium	Medium
	No-till row-crops with light to medium residues		Low	Low	Low
	Pasture/Hay or No-till row-crops with heavy residues		Low	Low	Low
2 to 5	Bare soil or conventional tillage	Silt loam (West TN)	Medium	Medium	High
		Silt loam	Low	Medium	Medium
		Other	Low	Low	Medium
	No-till row-crops with light to medium residues	Silt loam (West TN)	Low	Medium	Medium
		Silt loam	Low	Low	Medium
		Other	Low	Low	Low
	Pasture/Hay or No-till row-crops with heavy residues	Silt loam (West TN)	Low	Low	Low
		Silt loam	Low	Low	Low
		Other	Low	Low	Low
5 to 12	Bare soil or conventional tillage	All textures	High	High	High
	No-till row-crops with light to medium residues		Medium	High	High
	No-till row-crops with heavy residues		Low	Low	Medium
	Pasture/Hay		Low	Low	Low
> 12	Bare soil or conventional tillage	All textures	High	High	High
	No-till row-crops with light to medium residues		High	High	High
	No-till row-crops with heavy residues		Medium	Medium	Medium
	Pasture/Hay		Low	Low	Low

Low = Manure application prior to normal rainfall poses a low or negligible threat to water quality if manure is applied at an appropriate agronomic rate.

Medium = Manure application prior to normal rainfall could pose a threat to water quality if suitable conservation practices and appropriate agronomic rates are not employed.

High = Manure application prior to normal rainfall can pose a serious threat to water quality. Under most circumstances, manure application would not be recommended without strict conservation measures employed.

3. **Permanent Vegetative Buffer Width** considers the filtering effect of permanent vegetative buffers or woods at outlets to surface water. “Surface water” for the purposes of the P Index includes any permanent, continuous, physical conduit for transporting surface water, including permanent streams and ditches that only flow intermittently during the course of the year. Filtering effect must be from sheet flow across the buffer. Any concentrated flow across bare soil would require a structure to re-establish sheet flow across the buffer. Research has shown buffers as effective BMPs to keep sediment and other potential pollutants from leaving the field. Filter strips, field

borders, contour buffer strips, and riparian forest buffers are all examples of vegetative buffers. Permanent Vegetative Buffer must installed, constructed, and maintained in accordance with applicable NRCS Conservation Practice Standard. Permanent vegetative buffers do not receive fertilizer or manure P application. Fencing is needed to maintain permanent vegetative buffers in pastures; however, controlled grazing or hay harvesting will be permitted in the buffer to remove the nutrients contained in the plant biomass.

4. **Non-Application Width from Surface Water Source** is the distance from the edge of the cropped area to the nearest surface water. "Surface water" for the purposes of the P Index includes any permanent, continuous, physical conduit for transporting surface water, including permanent streams and ditches that only flow intermittently during the course of the year.

Part B: Phosphorus Loss Potential Due to Management Practices and Source Characteristics

5. **Soil Test P** considers the extractable P concentration for a 0-6 inch soil sample based on the Mehlich I soil testing procedure. Recent studies have demonstrated that soil test P levels may only play a small role in determining the amount of P in runoff.

6. **P (P_2O_5) Application Rate.** The source of phosphorus as well as the quantity is an important predictor of soluble P in runoff. Different multiplication factors are used for different P sources. The multiplication factor is highest for commercial fertilizer because of the greater availability and water solubility of phosphorus in these materials. For manure, compost, and biosolids the multiplication factor is lower because more of the phosphorus in these materials is less available. Some phosphorus is organically bound or in an organic form and will be released over a longer period than the P in fertilizers. The multiplication factor for alum amended poultry litter is even lower. A significant quantity of the phosphorus in poultry litter will react chemically with the aluminum in alum to produce relatively insoluble phosphorus compounds, significantly reducing the amount of soluble P in runoff.

   P Application Rate is based on the amount of P applied per crop or crop rotation/sequence. **<u>Example</u>**: If a producer wants to apply poultry litter to a fescue hay crop based on nitrogen, how is the P application rate determined. If it is determined that 2 tons of poultry litter can be applied per acre per year to the crop based on nitrogen, then 2 times the amount of P2O5 per ton of litter will be used. Therefore, 2 x 60 lbs. of P2O5/ton of litter = 120 lbs. of P2O5 applied per acre per year. One hundred twenty (120) lbs. of P2O5 per acre is the P application rate.

   <u>One-time application based on multiply-year crop uptake of P</u>. Suppose it is determined that a P-based nutrient plan must be implemented and land applying 0.7 tons of litter per acre based on crop P needs is not practical or economically feasible with available equipment. Then, *<u>a one-time application of litter can occur based on a multiple-year crop uptake of P as long as the resulting application rate does not exceed the one-year nitrogen needs of the crop</u>*. **<u>Example</u>**: If the nitrogen need for the fescue hay crop is 2 tons of litter per year, then 2 tons [yearly N need] divided by 0.7 tons [yearly P need] = 3; meaning once every 3rd year litter can be applied on this field for this crop).

7. **Application Timing** considers historical weather data for periods where most rainfall occurs and the active growing period for crops in Tennessee. The months where most rain occurs is also the time when crops are inactive.

8. **Application Method** considers the risk for P movement based how it is applied to the field, whether it is surface applied or incorporated.